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The Caloric Engine—Its History, Etc.

The accompanying engravings give a clear idea of one of the few special inventions of the period which arrests the attention of both the scientific and practical observer equally, owing to its remarkable cheapness and simplicity, and the novel agency employed to produce a motive power as a substitute for steam, which avoids all the evils of that dangerous and expensive element. It seems, among the various uses it can be employed, that it is especially adapted for the use of gas manufacturers and engineers as a cheap power, capable of pumping water for purifying purposes and running exhausters, etc. It requires little attention, and dispenses with the services of an engineer, any one of ordinary judgment being capable to manage it.

It is desired in the following to present to the public a concise and plain history of the numerous attempts which have from an early period been made to construct an engine, that would make the *application* of heated air as a motive power, a practical and useful result.

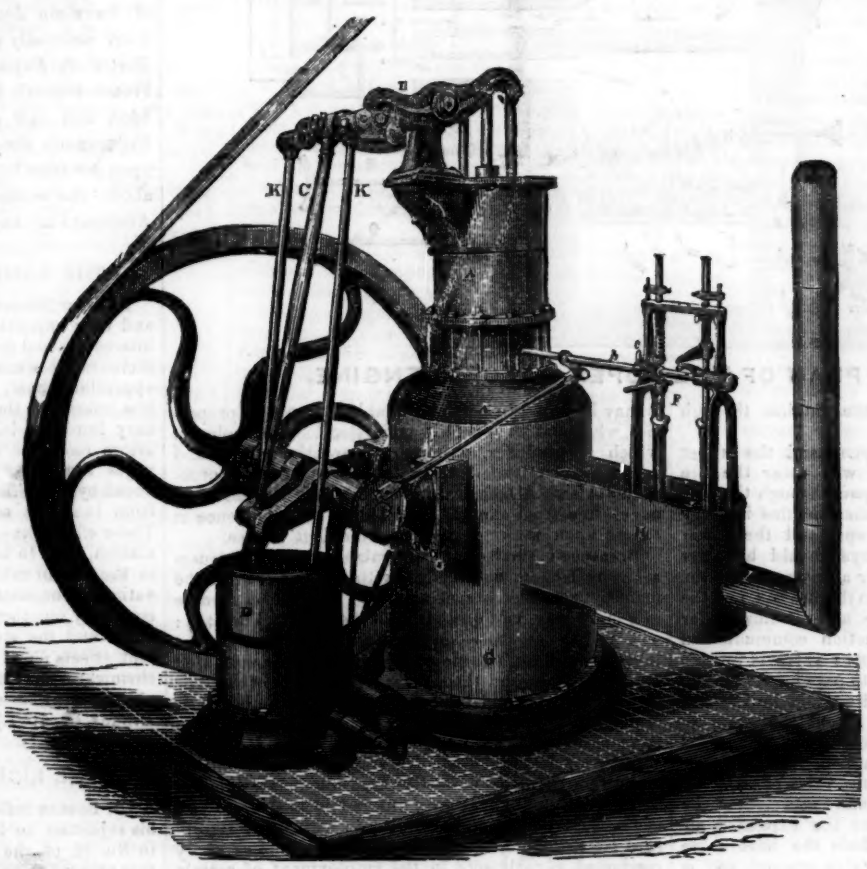
The knowledge of the principle involved in these efforts is very old, but it appears to have been first employed in a really efficient form by the Messrs. Stirling, of Scotland, in 1827; although at as early a date as 1816, the Rev. Dr. Stirling had patented an engine to operate by heated air, and actually had one in use in 1818 to pump water from a quarry.

Messrs. Parkinson & Crosly, of the City Road, London, in the year 1827, also constructed an air engine, in which the flame of gas was used to generate heat, and in 1833 Lieut. Ericson while a resident of England, brought out his caloric engine.

In 1837, Sir George Cayley Bart, also entered this field, and from that date until the past few years, numberless attempts have been made, both in this country and in Europe to accomplish the object sought.

It has long been conceded, that the most economical method of obtaining power yet known, is by the direct application of heat to the expansion of air, and although such approximations have been practically made as to clearly demonstrate the absolute truth of this fact, certain fatal errors in all machines heretofore constructed, have prevented their introduction to general use.

The "Roper Hot Air Engine," is by no means to be confounded with the so called "Caloric Engines," its predecessors. It differs from them in several most essential particulars as to its construction, and in the application of the principles involved, and has but recently been perfected after many years of persevering experiment and research, so that while it possesses all the advantages of the *application of heat directly to the expansion of air*, it is free from defects which have hitherto been so serious an obstacle to the general adoption of this motive power.



THE ROPER CALORIC ENGINE.

In order to obtain the full power of heated air, it is essential that the air should be conveyed directly through the fire, *thus securing the product of combustion*, and thence to the piston, free from dust and ashes, and not as in engines heretofore built, heated in a separate generator.

This has been accomplished by Mr. Roper, by using air tight doors, and fuel burned under pressure, which with the addition of a valve box and marine puppet valves with outside connections, successfully solved the problem of a perfect Hot-Air Engine, far superior to any of its predecessors, and which we confidently believe must entirely supercede their use.

1. The advantages of the "Roper Hot-Air Engine" are, that it runs comparatively without any noise; that it does not use upon the piston heated air alone, but the gaseous products of combustion as well, thus increasing its power, and holding a reserve for additional wants:

2. In its economy of fuel, requiring for a one horse power but 40 lbs. of hard coal per day of ten hours; for a two horse 80 lbs., and for a four horse 120 lbs.

3. In its simplicity of construction and small liability to get out of order, when the directions are strictly followed.

4. In its adaptability to all uses where small power is required, and the practicability of placing it in any part of a building.

5. In its perfect safety and exemption from extra insurance.

6. In its avoidance of the necessity for the employ ment of an experienced engineer, and in dispensing with the presence of water, so that it can be employed under circumstances, where it would be impossible to use steam.

With a new and lately improved governor, this engine, handsome in appearance, occupying small space, working with little or no noise, smoke or smell, and being free from all danger, is remarkably suitable for driving printing presses and shoe machinery, for machine shops, pumping, hoisting, turning, sawing, planing, ventilating and other industries.

It is protected by four different patents dating from 1862 to 1866. The first engines were built seven years ago and they have been improved from time to time, until it is believed to be perfect.

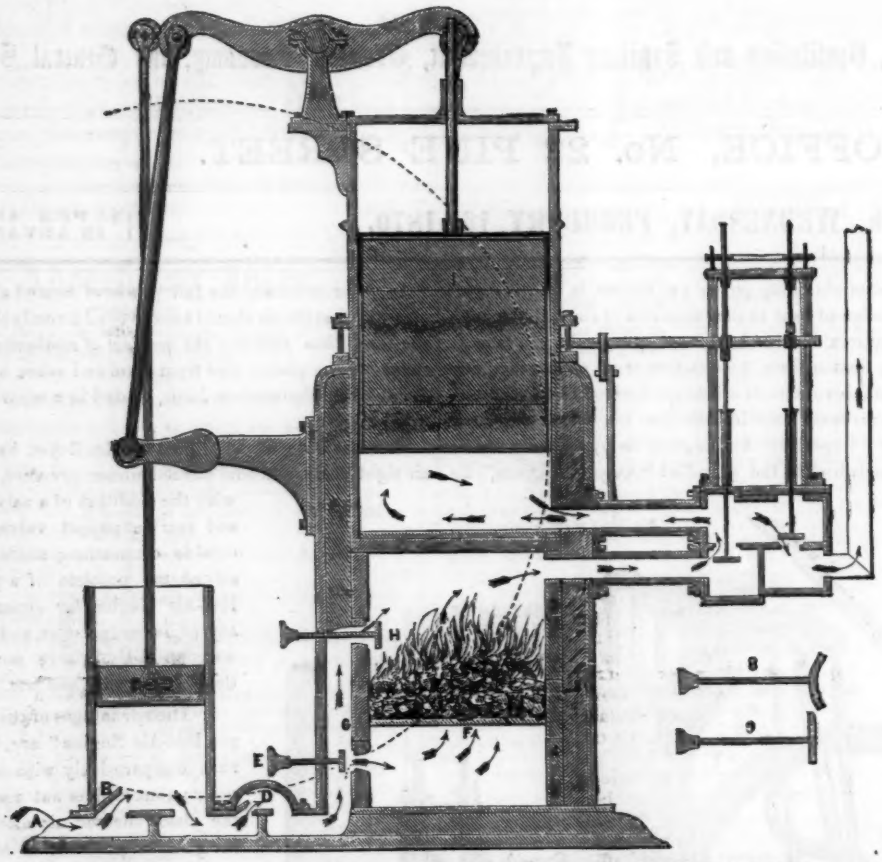
The Roper Caloric Engine Company having become the sole owners of the "Roper Hot-Air Engine," this company is now prepared to receive orders and furnish without delay, any number of one, two and four horse power engines at prices ranging from $550, $750 and $950 for the respective powers. They are warranted perfect and complete, and the full power claimed and delivered at any place in the city, free of transportation.

These engines will actually work from one-half to a full horse power above what is claimed for them.

The weight of these engines is 2,200, 3,300 and 5,000 lbs. respectively, and occupy from five to six feet square of room.

The following is a description of the engine:

The cold air is drawn in by the Air Pump at the opening (A), on the return of the Plunger the valve (B)



SECTIONAL PLAN OF THE ROPER CALORIC ENGINE.

closes, and the air is forced into the Engine through the Check Valve (D.)

If the lower damper (E) is open, and the upper damper (H) is closed, all the air will enter the fire chamber under the grate (F) and pass through the fire, as is customary in building it, or when the fire is very low. If the upper damper (H) is open and the lower damper (E) is closed, as they always should be after the fire is in good condition, the air all passes over the fire. The expansion takes place in the fire box, and the doors being closed air-tight, the air remains under pressure until by the eccentric motion communicated to the valve toes, the inward poppet valve is opened which allows the compressed air to pass into the cylinder which forces the piston up, [its place in the fire chamber being supplied with cold air at the same instant by the downward movement of the pump plunger.]

At this moment, by the same motion, the outlet or exhaust valve is opened and the inlet valve closed.

The force of the balance wheel, and the weight of the piston brings the piston back, and the expanded air returning by the same passage, finds the inlet valve closed and the outlet or exhaust valve opened and is discharged through the funnel or chimney.

No. 1 of the sectional cut is the piston, on the top of which is fastened the leather packing.

No 2 of the same cut is the piston drum, made long to keep the packing distant from the fire.

The outer or heavy shaded portion of the engine is the shell.

No. 3 is non-conducting material, filled in between the shell and sheet-iron lining which surrounds the fire brick.

No. 4 is the fire-brick lining of the fire box furnace.

Agencies will be established in the principal cities, where duplicate parts of every engine can be secured when required, as well as the services of a competent engineer to set them up, and answer all calls.

For further information, address "Roper Caloric Engine Company," 49 Courtlandt street, New York.

The Inhalation of Carbonic Acid.

The old idea, that carbonic acid is in itself a *poison* still prevails to a considerable extent, even among well informed people. Carbonic acid exerts no more corrosive or poisonous influence upon the system than water. Water deprives persons of life, when they are immersed in it, by excluding oxygen from the respiratory organs; and this is why fatal effects are obtained from carbonic acid. Carbonic oxide (CO), when inhaled, is poisonous; it acts upon tissues, produces chemical changes in the blood, and arrests respiration.

Not so carbonic acid: we can *drown* in it; but it is in no sense a *poison*. From laboratory experiments in inhaling carbonic acid, we are led to think that possibly it may be found to possess valuable therapeutic properties, when its nature is fully understood. The asphyxia which it produces, although apparently painful and injurious, or attended with fatal consequences, is probably not so. A techincal laboratory may be said to be never free from the gas; and the only influence it exerts upon workmen is of a somnolent nature.

Breathed in small quantities, mixed with air, it causes a sleepy feeling, unattended with headache. In the manufacture of nitrate of ammonia from the carbonate in a large way, vast quantities of the gas are liberated: and we have seen mice, in attempting to run across the laboratory floor, tumble over, and remain asphyxiated for a long time, and then, upon a subsidence of the flow of gas, recover, and scamper away as if nothing had happened. The dog, which so many of our readers have seen thrust into the celebrated cave, *Grotto del Cane*, near Naples, evidently suffers but very little; and although made perfectly insensible many times in a day, is not apparently injured in health. These examples, when taken in connection with other significant facts, incline us to think that a series of carefully conducted experiments in the employment of certain quantities of carbonic acid, diluted with air may lead to the discovery of a peculiar anæsthetic, or sleep-producing agent, of a simple and desirable nature.

If the pressure of exacting duties permits, we intend to institute a series of experiments of the nature indicated, at no distant day; and our readers will know of the results.—*Exchange.*

[We advise the writer to try the experiments upon himself for a period and see if, like the mice, he will "revive and scamper away." Depriving the lungs of oxygen does not act as a direct poison upon the system it is so indirectly, and we very much question its "therapeutic qualities."—Eds.]

Chemical Repertory.--No. 23.

FEBRUARY 16, 1870.

Editor—HENRY WURTZ.

Editorial.

SCIENTIFIC SCRAPS.

ORIGINAL AND SELECTED.

Fiat Justitia.—"Proposed" recognition of *meum* and *tuum* in the matter of Brains. The telegraph says that: "An Act of Parliament is proposed to protect foreign inventions sent to the Workman's Exhibition to be held here." This looks to a great stride, not in advance of, but in *catching* up to, the "spirit of the age." It is certainly to be hoped that the British legislators of the day may be found to be morally on a par with American Congressmen of the last generation, who incorporated into the very essence of our Patent Law the recognition of the right of property in brain-work, without regard to nationality; while it is notorious that the British law was expresely framed to instigate and stimulate the *importation* (that is, piracy) of valuable inventions. Had the French done something similar previous to their late Exposition, it would have prevented such occurrences as that we have already recounted in these columns (REPERTORY, No. 10: of July 16, 1869, page 29); that is, an unprincipled attempt of a brace of Frenchmen to appropriate bodily the Thermo-Electric apparatus exhibited there by MOSES G. FARMER, our distinguished American Electrician; which attempt was magnanimously exposed by EDMOND BECQUEREL, when impudently thrust by the depredators before that august body the Academy of Sciences. We revive this subject because we regret to find, going the round of American Journals at present (among which we must especially cite our valuable contemporary *Van Nostrand's Engineering Magazine*) notices taken from French Journals describing and commenting favorably upon this new and admirable French (!) invention, BECQUEREL'S condemnation being ignored. We call upon our friend ALEXANDER HOLLY to rise, in this case, above the ordinary prejudices and predilections we Americans all have in favor of Frenchmen.—H. W.

THE LIGHT OF PHOSPHORESCENCE.

EDMUND BECQUEREL has of late communicated further and very important results of his investigations on this interesting and mysterious class of phenomena, which includes those cases in which light is given out without appreciable heat, or at least at temperatures more or less inferior to the degree of heat necessary to the ordinary luminous incandescence of solids. We can but assign room for his concluding remarks, in which he urges the study of "the phosphorescent effects produced by the different refrangible rays which emanate from luminous sources, both artificial and natural. These effects, like the chemical actions produced by radiation, need to be of but feeble intensity, far less than in the case of calorific rays, to be susceptible of observation. For instance, rays from sources scarce appreciable by our thermoscopic means, as those from the moon and the stars, afford very manifest phosphorescent effects; and moreover produce quite energetic chemical reactions." Into these new and interesting paths he promises to direct his researches (*Comptes Rendus*, 69, 1001.)—H. W.

THE LIGHTNING-ROD DISCUSSION.

Dr. BUNKER informs us by letter that we may expect his rejoinder to Dr. VAN DER WEYDE'S communication in No. 22 of the REPERTORY; promising it in fact for this present issue; but up to our going to press it has failed to turn up. We shall hope to have it for our next.—H. W.

Justly Merited Compliment to the SECRETARY *of the* SMITHSONIAN INSTITUTION.—In the *Comptes Rendus* of Dec. 27th, 1869, we find a report of the *Secret Committee* of the *Section of Physics* of the Academy, presenting candidates for the vacancy among the eight Foreign Correspondents of the Academy created by the death of MARIANINI; among which we recognize without doubt (though mistakenly reported as "M. HENRY, *d Philadelphie*") our own eminent scientist, the discoverer of the intensity current and the induction coil, etc., etc. He is here ranked by this Committee, whose

Chairman was BECQUEREL, with such names as ANGSTROM, JOULE, KIRCHHOFF, MAYER, Sir WM. THOMSON TYNDALL, &c. We have not yet received the result of the election, though long since due. The delays and irregularities in the receipt of French journals are in fact most annoying and inexplicable.—H. W.

GAS PURIFICATION.

The American Iron-Ore Process.

We have already repeatedly alluded to the important improvements in iron-purification of Messrs. ST JOHN & CARTWRIGHT at the 21st Street Station of the New York Gas-Light Co. In the last issue we promised further detailed information on this subject, and it is our intention soon to describe the new and extensive Purifying House recently erected by this company to operate on ST JOHN & CARTWRIGHT'S principle, and comprising their new devices. At present we shall rest satisfied with presenting an extract from a recent Report to the Metropolitan Board of Health by Prof. CHANDLER. Of this Report, having received a full and authorized copy from the Professor, we shall present further portions in our next.—H. W.

(From Prof. CHANDLER'S Report.)

THE IRON ORE PROCESS.—A few months after Laming introduced the artificial sesquioxide of iron in France Mr. J. M. Hills applied the natural hydrated sesquioxide of iron, or "bog iron ore," in England. This material, like the Laming mixture, may be used again and again, and does not evolve offensive odors when exposed to the air. A modification of this process is now used by the New York Gas-Light Company of this city. It was invented by Messrs. ST JOHN & CARTWRIGHT, and has been in use nearly two years, giving entire satisfaction. As the bog iron ores of this neighborhood are not sufficiently pulverulent to act promptly on the gas, Messrs. ST JOHN & CARTWRIGHT add to the ore a quantity of iron borings or turnings, which they then convert into an artificial hydrated sesquioxide of iron by moistening the whole with ammoniacal liquor and exposing it to the air. The resulting mixture of natural and artificial oxide receives an addition of coarsely pulverized charcoal. This mixture is always sprinkled with ammoniacal water before it is placed in the purifier.

The material now in daily use at the works of the New York Gas-Light Company was introduced in April, 1863. Occasional additions of iron borings have been made to it; otherwise the material is the same. When last tested it contained 30 per cent of sulphur. In Germany several varieties of sesquioxide of iron are now in use, prominent among which are the "Oberuseler mixture," an iron ore containing some oxide of manganese; the "Manheim oxide," and "Delcke's oxide," very pure artificial oxides of iron.

CORRESPONDENCE.

Professor HENRY WURTZ:

Why does light appear and sound occur when electricity passes from one cloud to another? And though light appears, why does not sound always occur?

Atmospheric air constantly holds in suspension more or less water vapor. As the electric fluid passes through the atmosphere it pierces this water vapor so held in suspension, and the heat engendered by the friction occasioned thereby, dissociates the oxygen and hydrogen of which the vapor is comprised, and ignites those gases, leaving a trail of brilliant light. When a volume of the fluid passes through the atmosphere, it likewise occasions a *vacuum*, and the return of its separated parts, by its own pressure, occasions concussion or sound. Chain or forked lightning is thus exhibited, giving forth continuous detonations in consequence of different distances and angles from the ear. And when too far for hearing we still may see the chain of light. But when the electric fluid passes in sheets or small streams through the atmosphere no sound is produced, as no *vacuum* is occasioned. Each second of time sound moves but 1142 feet, while light and electricity move equally at the rate of 200,000 miles, and have been twins in creation since God said, "Let there be light, and there was light." VETO

[The idea that the light of the electric spark in air is due to recombustion of dissociated water is overthrown by the consideration that the presence of watery vapor is not necessary to the spark. Most of the other views of *Veto* are familiarly set forth in books on Electricity. That relating to the crashing roll of thunder being due to the zigzag path making the flash highly variable in its distance from the ear, has long been universally accepted and is indisputable; but the old idea still found in many of the school-books that the noise of lightning is produced *altogether* by the collapsing of the air into the vacuous path, could not be accepted by the present writer, as he believes it rather or chiefly due to the direct and stupendous energy and velocity of the initial blow, which cleaves the atmosphere to such distances in a millionth of a second, and which must engender a sonorous wave of far greater intensity than the later one produced by the collapse. The question *Veto* raises as to the nature of "sheet-lightning" without sound, is one that has been much discussed, but not yet settled. We should like much the views of other readers upon this. The writer is much pleased with such letters as that of *Veto*, and hopes he will write the like again, "early and often."

H. W.]

DISSOCIATION.

At a meeting of the New York Lyceum of Natural History on the 14th inst., Prof. SEELY read a paper, of which the following is an abstract:

The word *dissociation* is not needed. It is not so exact and so expressive as the phrase decomposition by heat. A new word which brings no new fact or thought is always embarrassing.

The amount of force concerned in producing a change in matter is precisely the same as that concerned in restoring the *status quo;* the work or effect in the two cases as to its quantity is the same. The application of this law to practical mechanics has long been understood, but it is only recently that the law has been declared to be true of all phenomena of matter. The force concerned in bringing substances into chemical union is equivalent to the force required to separate them again; the force of affinity is equivalent to the force of decomposition. All forces may be estimated in terms of heat, and it is probably true that many and possibly all chemical compounds may be resolved into their elements by the agency of heat alone. Most chemical unions are accompanied with an evolution of heat. It has been supposed by some that in certain of these cases—for example the burning of hydrogen with oxygen, the heat evolved was a measure of all the force concerned in the reaction, and that the heat required for decomposition was in amount the same. But the theory has no sufficient foundation—heat by no means is the only force brought into action in these cases. It has also been erroneously supposed that there was some other exact relation of the quantity of heat of composition and of decomposition. Still more are facts wanting to show a relation between the temperature (or intensity of heat) of union and decomposition.

The strength of affinity which holds together the elements of a compound may be greatly modified by heat, and it appears that *the bonds of affinity are progressively weakened by constant additions of heat.* In the cases of single elective affinity this proposition finds a familiar illustration. A compound A+B yields up its B to C with promptness as it is heated; the bonds of A to B are weakened by the heat and the labor of C is thereby so much lessened. Near the point of decomposition by heat alone, the affinity is at its minimum, and causes which at lower temperatures might be altogether inoperative may promptly determine the decomposition. As such causes are likely to be present in any actual cases, it may be impossible to arrive at the normal temperature of decomposition by heat alone. In practice it has been found that the temperature of decomposition is often below that of union, a fact which was easily anticipated. The phenomena of union in such cases is of necessity somewhat complex, for the temperature of union being above that of decomposition, the latter also must take place; in flames there may be a succession of decompositions before a stable union is effected.

American Chemical News.

DR. B. A. GOULD "ON THE CONSTITUTION OF THE SUN."

[*Concluded from page* 36.]

GRANULAR SURFACE OF THE SUN.

About the year 1863 Mr. NASMYTH announced the discovery that with a powerful telescope of sharp defining power, and under favorable atmospheric conditions, the whole luminous surface of the sun appear to consist of a thin layer of bright filaments shaped like willow-leaves, averaging about 1,000 miles in length and 100 in breadth; that these lay scattered over the sun generally in every variety of direction, across each other, and that the black points were simply the interstices between these willow-leaf filaments. This announcement stimulated at once to very minute scrutiny of the face of the sun, and to an active controversy among the observers. All agreed that the luminous surface was composed of bright particles, but NASMYTH'S description found but little confirmation. One observer proposed the term rice grains, as better representing the form of the objects in question, and another compared them to gravel on the beach, and a third preferred the word granulations. The facts established have been very clearly set forth by Mr. HUGGINS of London. The granules are of various sizes, but may on the average be roughly taken as about 1½" in length, and 1" in breadth, corresponding to about 675 by 450 miles. Some are nearly round, others oval, and others still almost without symmetry of outline. The coarser mottling of the solar disc arises chiefly from the alternation of lines or groups of closely aggregated granules and of regions in which they are less abundant. The points are the interstices between them, as they appear through a telescope of insufficient power. Mr. HUGGINS sums up most admirably by saying: "The phenomenon would be well represented if we might suppose that the granules are recently condensed incandescent clouds; that they slowly sink, merge into each other, become less and less luminous, and gradually dissipate into comparatively non-luminous gas. The dark pores would then be represented by the portions where complete vaporization had taken place."

DIMINUTION OF THE SUN'S FORCE.

The great fact, to which I have more than once alluded, that the sun is practically our only source of earthly power and energy, gives a peculiar interest to the question whether his brilliancy or thermal energy are undergoing any perceptible diminution. That they are diminishing we must assume on general principles, inasmuch as we know to what an inconceivable extent he is radiating force in the various forms of heat, light, and chemical power, and force once emitted from a source of such superior energy is not returned to it again, while a new creation of force by natural agencies is just as impossible as a new creation of matter. But whether any diminution of radiant energy in consequence of the enormous expenditure is perceptible by our means of investigation is a most natural and important question, and to this it must be answered that no appreciable decrease has been detected. Few observations available for the purpose have been bequeathed us by the astronomers of former days; but from some careful observations made in 1801 by the distinguished astronomer, OLBERS, upon the brilliancy of Mars, which depends, of course, upon reflected solar light, Prof. SEIDEL of Munich was able to prove in 1859 that the solar light had not diminished in the interval to any measurable extent. It has been well said, that had some of the old Greek metaphysicians once dipped a thermometer in the Kissus, and recorded the date and temperature, it would have added a thousand fold more to our knowledge than all their speculations did. We can forgive them for this omission, if for no other reason than that they had no thermometers to dip but had they ever recorded the average date of flowering of any common plants, we should be able to thank them for at least some materials whence we could deduce valuable geological and even cosmological knowledge.

In 1843, after SCHWABE had carried on his spot observations for 16 years, he discovered that their frequency was periodic, and he estimated the length of the period at about 10 years. Subsequent observations have most fully corroborated this important discovery, and the accompanying tabular view presents a summary of the results obtained by SCHWABE since the beginning of his series of observations.

FREQUENCY OF SPOTS ON THE SUN.

Year.	No. of Days.	No. of Groups.	Days without Spots.	Year.	No. of Days.	No. of Groups.	Days without Spots.
1826..277	118	22		1848..278	330	0	
1827..272	161	2		1849..285	238	0	
1828..282	225	0		1850..308	186		
1829..244	199	0		1851..308	151	0	
1830..217	10	1		1852..337	124	2	
1831..239	149	3		1853..279	91	4	
1832..270	83	39		1854..334	67	65	
1833..267	33	139		1855..313	79	146	
1834..273	51	120		1856..321	34	193	
1835..244	173	18		1857..324	98	52	
1836..200	272	0		1858..335	202	0	
1837..168	333	0		1859..843	205	0	
1838..202	282	0		1860..332	210	0	
1839..205	163	0		1861..322	204	0	
1840..263	452	3		1862..317	160	3	
1841..283	102	15		1863..330	124	2	
1842..327	68	64		1864 324	150	4	
1843..312	34	149		1865..307	93	26	
1844..321	52	111		1866..349	45	76	
1845..332	114	29		1867..312	25	195	
1846..314	157	1		1868..301	23	101	
1847..276	257	0					

In 1852, nine years after SCHWABE'S discovery, Prof. WOLF of Berne, was led by careful study of the observations in connection with ancient records to a modification in the length of the period, which is now fixed at about 11 1-0 years.

THE SUN'S LIGHT.

In addition to the study of the quantity and intensity of light, two modes of investigating its quality are known to us. One is by discovering in what planes the luminous undulations occur, the other is by determining the proportions of rays of each degree of refrangibility which it contains. By the first method, viz., by the use of the polariscope, we are generally enabled to discover if light reaching us has been reflected, or directly emitted by the luminous body, and if that body is solid, liquid, or gaseous. By the second, viz., by the use of the spectroscope, we are enabled to analyze each ray of solar light, and to infer from what incandescent chemical elements it comes, at what temperature it has been emitted, and through what forms of vapor it has passed. Few subjects are more fascinating than these, but I may not stop to set forth the processes involved, or to speak of the still active progress of discovery in these directions.

ECLIPSES.

The first sight which attracts attention when the last direct ray of the sun has been cut off by the advancing moon is this round orb in almost inky blackness against a luminous background, and the whole surrounded by a bright glory, which has received the name of the corona, or crown. This appears to have been seen in all total eclipses, for even ancient Greek authors mention it; yet the descriptions and representations of it vary in a remarkable degree. In some of the drawings it is depicted as a bright halo, concentric with the black disc of the moon, and of nearly uniform width; in some it is a glory of radiant beams; in others some of the beams are twice or three times the length of the rest; sometimes there are four, sometimes two, sometimes six such projecting beams of light. In judging of the degree of accuracy in these, there are many considerations to be kept in mind, such as—that the corona has only lately been made the subject of special observation; that the observations have generally been made through telescopes which magnified too much to allow the whole discs of the sun and moon to be seen at once; and that the sketches have almost always been made from memory at some subsequent time.

THE PROTUBERANCES.

In allusion to the exerescences from various portions of the sun's disc, which are most frequently seen as rose-colored, sometimes, however, deep red, clear white or even yellow, Dr. G. said: These are actually portions of the sun, and the moon in her motion gradually hides those in front of her, and discloses those which are on the other side. They are called the protuberances, and it is only within the last two years that we have attained any definite knowledge of their character. They are not always even in apparent contact with the sun, but often seem to float like clouds above his surface, and assume many fantastic shapes, curved, forked, twisted and jagged.

But it was the spectroscope, which at the total eclipse of 1868 was for the first time directed to the protuberances, that the largest additions to our knowledge are due on that occasion. By means of this wonderful instrument it was found that the protuberances are very unstable and variable in their forms, and in fact merely local aggregations of a gaseous medium which entirely surrounds the sun, and may at any time be detected by the spectroscope in any part of the limb. For this envelope, which is a real one, LOCKYER proposed the name of "chromosphere," and its structure and chemical composition have since that time been the objects of continual investigation by numerous observers. It has been satisfactorily established that the light which it sends us is chiefly due to incandescent hydrogen, and usually contains indications of the presence of sodium, barium, magnesium, iron, and perhaps other metallic elements.

MECHANICAL ORIGIN OF THE SUN'S LIGHT AND HEAT.

The forces radiating from the sun cannot be due to combustion, in as much as this would be inadequate to afford the supply; and yet, as they must be in process of continual development from sources in which they previously existed in some other forms than as heat and light, since some amount of cooling and fading would otherwise inevitably be within the range of our detective powers, there remains but one explanation open to us, out of all those which science can at present suggest. This is that the light and heat are the results of mechanical action, and that forces which were previously engaged in producing motion, are, by the arrest of that motion, made to appear in this new form, just as iron grows hot under the blows of a hammer, or an axle takes fire in consequence of friction. From this inference there seems indeed no escape: but what is the motion which is thus converted? And where are the moving bodies, which are endowed with such mighty force, and are encountering such enormous resistance as to evoke the tremendous radiance of the sun from a previous momentum adequate to produce it?

Dr. GOULD then gave an account of the meteoric theory of solar heat, and showed the objections which could reasonably be urged against it, and then proceeded to explain the theory of contraction, to which he gave his adherence, as well as in general to the theory of FAYE, according to which the sun is a gaseous mass at a high temperature, the outer circumference being condensed by the extreme cold of the planetary spaces.

[For some remarks on the theory referred to here, as attributed to FAYE, see the editorial on this subject, in the REPERTORY, No. 20, of Dec. 16, 1869.—H. W.]

A NEW PROCESS FOR THE EXTRACTION OF COPPER FROM ITS ORES.

By DR. T. S. HUNT, F.R.S., AND JAS. DOUGLAS, JR., ESQ

[This new process, for which Letters Patent have been granted in the United States, Great Britain, Canada and Newfoundland, may be understood from the specification of the British patent, given below, to which are appended a series af explanatory notes and comments. The date of the patent in Canada is Jan. 14, 1869, in the United States, Feb. 9, 1869, and in the United Kingdom, Aug. 13, 1868.]

SPECIFICATION.

1. For the extraction of copper from its ores by this process it should be in the state of an oxyd or compound thereof, as oxychlorid or carbonate. These oxydized forms of copper are decomposed under proper conditions by protochlorid of iron, with the production of dichlorid of copper, which is soluble in certain saline solutions, and in some cases of a portion of protochlorid of copper, together with insoluble peroxyd of iron, and more or less insoluble oxychlorid or basic persalt of iron, which may be rendered soluble by the action of sulphurous acid.

2. The naturally or artificially oxydized ores are to be digested with a watery solution of neutral protochlorid of iron, with or without the addition of an earthy or alkaline chlorid, as common salt. The neutral protochlorid of iron may be conveniently prepared by double decomposition of protosulphate of iron with an equivalent of chlorid of calcium or chlorid of sodium. In preparing the solution, hereinafter designated as the bath, we may proceed as follows:

3. One hundred and twenty (120) pounds of sea salt, or one hundred and twelve (112) pounds of dry chlorid of calcium, or its equivalent of hydrated chlorid, are to be dissolved with two hundred and eighty (280) pounds of protosulphate of iron, (green copperas,) in one hundred (100) imperial gallons of water. In place of the above salts we may substitute an amount of protochlorid of iron prepared by any other method, containing fifty-six (56) pounds of metallic iron. To the bath prepared in either way, two hundred (200) pounds of sea salt are then added, when the solution is ready for use, and will be found capable of chloridizing and dissolving about ninety (90) pounds of copper. The power of brine to dissolve the dichlorid of copper formed increases greatly with the strength and temperature. The proportions above given are convenient, but in case of poor ores, a solution of one-half the strength may be used with advantage.

4. In the treatment of copper ores by this process, they may be divided into two classes, non sulphuretted and sulphuretted ores.

5. The first class or non-sulphuretted oxydized ores, includes the native oxyds of copper, the carbonates, and the oxychlorid. To prepare these for treatment they should be finely pulverized, and the carbonates may with advantage be gently calcined before or after grinding, in order to expel carbonic acid. The red oxyd, if alone or greatly predominating, should also be gently calcined after grinding to convert it into protoxyd; but if it be mixed with a considerable proportion of protoxydized ore this is not necessary.

6. The pulverized oxydized ores thus prepared are to be digested in the above bath with frequent agitation. Heat is not necessary, but it accelerates the solution of the oxyd of copper, which in practice should not be more than sufficient to yield sixty or seventy pounds of copper to the above bath of one hundred gallons. When the solution is complete and the liquid drawn off, the insoluble residue should be lixiviated with a small volume of hot strong brine. The liquid is then digested with metallic iron, by which the copper is thrown down as cement copper, two parts of iron yielding three parts of metallic copper.

7. The bath thus freed from copper contains a large amount of regenerated protochlorid of iron, and can be used at once to treat a fresh portion of oxydized ore. A small loss of chlorine, which separates as oxychlorid of iron, has, however, to be supplied by adding to the bath, from time to time, protochlorid of iron or the salts required to produce it. This need not, however, exceed for each repetition, one-eighth of the original quantity, and by careful exclusion of the air the quantity to be added each time may be reduced to much less. The strength of the bath in protochlorid of iron should be determined from time to time by appropriate tests.

8. In localities where it may be desirable to economize the protochlorid of iron a modification of the process may be adopted, which consists in treating with sulphurous acid the iron compounds precipitated by the oxyd of copper. To this end sulphurous acid from the roasting of sulphuretted ores, or from any other source, may be made to pass over or through the bath after or during the process of dissolving the oxyd of copper. In this case the protosalts of iron are constantly regenerated, and serve to chloridize fresh portions of oxyd of copper. A small amount of protochlorid of iron, with the aid of sulphurous acid, may, in this modification, be used to convert a large quantity of copper into dichlorid, the excess of which is precipitated, and may be washed out with hot strong brine. As this deposits a large quantity in cooling, the same brine may be employed indefinitely for dissolving dichlorid by heating and cooling it each time.

9. The solid dichlorid is rapidly reduced by contact with metallic iron, especially when wet with brine, and yields metallic copper and protochlorid of iron, one part of iron giving two of copper. To prevent any precipitation of oxychlorid of copper from the dichlorid solution by the air, it is well in all cases to have a small portion of protosalt of iron present. A little free sulphurous acid will also prevent such precipitation; but any excess of this gas should be expelled or allowed to escape from the solution before adding metallic iron.

10. In the case of sulphuretted ores, the first step in the application of our process has for its object to convert the metal into an oxyd soluble in the bath already described. This conversion is effected by calcination in the air, by which means all copper, iron and sulphur are oxydized. [Pyritous ores, holding much iron and sulphur, may be roasted in kilns, then ground and recalcined, but native sulphurets, rich in copper, or regulus, should be ground before calcination, which is best done in a muffle furnace. In either case] a low red heat suffices, and what is called a dead roast is to be avoided, not only because it involves a waste of time and fuel, but because the high temperature renders a portion of the oxyd of copper insoluble in the protochlorid of iron bath. The roasting need be continued only until the complete oxydation of the sulphuret of copper, and its conversion into a mixture of oxyd with a variable proportion of sulphate of copper. This product may be treated directly with the bath, without addition, as directed for non-sulphuretted ores, but the excess of sulphates thus introduced renders the bath impure, and much more metallic iron is required for the subsequent precipitation than when the whole of the copper is in the form of oxyd.

11. We therefore prefer to proceed as follows: We determine in the roasted ore the amount of copper present as sulphate, which will vary very little for any given ore roasted under constant conditions, and we add thereto an equivalent of lime, which gives rise to insoluble sulphate of lime and oxyd of copper. In practice it is well to leave undecomposed a small amount of sulphate of copper, which, in a subsequent stage of the process, will give with metallic iron the sulphate of iron required to replace the small loss already mentioned as occurring when sulphurous acid is not used. To an ore, for instance, with eight per cent. of copper as oxyd, and five per cent. as sulphate, we may add lime enough to decompose four fifths of the latter, at the rate of 28·0 parts of pure lime for 31·7 parts of copper, or about an equal weight of ordinary non magnesian lime; being four pounds of finely ground lime for each one hundred pounds of the above roasted ore. An equivalent quantity of carbonate of lime, or other alkaline or earthy base, may be used instead of quicklime, but with less advantage. The roasted ore and lime may be added to the bath together, or better, the ore is to be added first. The subsequent part of the process is to be conducted as already described for the ores of the first class.

12. When protosulphate of iron is used instead of the protochlorid in preparing the bath, or in keeping up its strength, as in the case of ores of the first class, sulphate of soda is formed, which may in great part be crystallized out by extremes of heat and cold. The formation and accumulation of this sulphate may, however, be prevented by the use of chlorid of calcium as already set forth. The still larger production of sulphate of soda, which would take place if calcined ores of the second class were added directly to the bath, is prevented by the use of lime as already described, and that portion which must result from the excess of sulphate of copper, as recommended, may be decomposed by the addition of small portions of chlorid of calcium from time to time. By attending to these precautions the strength of the bath in chlorid of sodium, and its solvent power may be indefinitely maintained.

13. We do not claim the use of any particular form of furnace, nor of any special arrangements for calcining, lixiviating or precipitating, reserving to ourselves the choice of the best forms of apparatus for these purposes; neither do we claim the use of protosalts of iron other-

wise than in solution, nor the use of perchlorid or other persalts of iron, nor yet the use of sulphurous acid save and except in connection with protosalts of iron, as already set forth.

14. What we claim as our invention is:

I. The use and application of a solution of neutral protochlorid of iron, or of mixtures containing it, for the purpose of converting the oxyd or suboxyd of copper, or their compounds, into chlorids of copper.

II. The use of sulphurous acid for the purpose of decomposing the oxychlorid of iron formed in the preceding reaction.

III. The use of a process for the purpose of extracting copper from its naturally or artificially oxydized compounds by the aid of the first, or the first and second of the above reactions, substantially in the manner already set forth.

[*To be continued in our next*]

Extension of the Rochester Gas Works.

[From the Rochester Daily Chronicle.]

It has been unnoticed, generally, that the Rochester gaslight company have been making a considerable extension on the grounds north of and adjoining the original works, purchased two years ago of Samuel Moulson. The company now own and occupy the extensive territory bounded east by the Genesee river, west by Front street, south by Mumford street and north by the property of the New York Central railroad. The extension, which has been, so to speak, finished, will answer any reasonable contingency for the next ten years, enabling the company to make 500,000 cubic feet of gas per day, instead of 300,000 feet, as before. This amount will do for any increase of the inhabitation to 150,000, or perhaps more.

THE BUILDINGS

were erected and inclosed in the summer of 1868. The excavations and mason work were done under contract by Messrs. Geo. H. Thompson & Co., and the buildings are in all respects of the most substantial kind. The iron roofing was built by Thos. G. Palmer, the woodwork by John Bell and the slating by W. G. Frutchey, all well known mechanics of this city. The working drawings for the buildings were made by Michael Verhoeven, an employee of the company.

THE RETORT HOUSE.

This building is 139 feet long by 55 feet wide, and the walls 25 feet high, relieved on both front and rear elevations by antas and projecting cornice. In the center of this building is constructed a range of 15 double retort benches of 5 retorts each, making in all 30 benches with 150 retorts. These erections were made by Michael Verhoeven who has been in the employ of the company for several years and is thoroughly experienced in this department of work. The settings of retorts, hydraulic mains, stand pipes, etc., were all done by Mr. Voerhaven, and constitute one of the neatest and most complete portions of the whole work. The floor of the retort house is laid in Medina flagging in Messrs. Whitmore, Carson & Co's best style. The yard for depositing coke is convenient and spacious, and is paved with coal-tar cement from six to eight inches in thickness.

THE PURIFYING HOUSE

is 55 feet by 41 in clear, and the walls 18 feet high; the roof trussed, of wood, painted neatly on the under side, and covered with slate. The basement is 9 feet in clear, the floor laid in concrete, and the hight of pipes connecting the boxes sufficient to enable a man to walk upright under them with ease. On the upper floor are four purifying boxes, 12 by 20 feet square, with capacity for seven layers of sieves to receive the lime. The boxes and pipes are supported by iron columns, which renders the basement light and airy. A partition at the north end of the purifying house separates the depositories for new and old lime from the main room, and the center seal is also separated by another partition at the south end. The center seal is a very simple but ingenious method of changing the flow of gas from one box to another, when necessary to renew the lime for purification. Over the center seal, and elevated on iron gairts, is a water tank 29 feet long, 11 feet wide and 4 feet high, capable of containing 265 barrels of water, which was manufactured and set up by the Kidd foundry and steam engine works of this city. Water is pumped into this tank from the river, and distributed under an ample head to all parts of the premises when needed.

CONDENSING ROOM.

This room is 41 by 38 feet square, and the walls 26 feet high, the roof trussed and slated and neatly painted underside. Between the retort and purifying houses is an open court extending the whole length, and is 28 feet wide. The gas passes from the retorts across this court into the exhauster room, and then back into an elevated section of air condensers—the pipes 10 inches in diameter and arranged in triplets. In the same room are two scrubbers, which are upright cast-iron cylinders five feet in diameter and 15 feet high. The gas passes from the condensers into these scrubbers, which are differently arranged with jets of water entering at the top, while the gas which enters at the bottom passes through or in contact with the water, by which process the tar and ammoniacal liquor is condensed and deposited in the tar-well directly under this room. The size of the condensing room is ample for any additional apparatus for this purpose which may be needed. This room also contains the necessary pipes and valves for passing the gas by or around any part of the apparatus which may need examination or repairs. All the connecting pipes from the hydraulic main in the retort house to the gasholders are sixteen inches in diameter. The purifying, condensing, and scrubbing apparatus, with hydraulic mains and stand pipes, and the connections for the same, were furnished under contract by Messrs. Jesse W. Starr & Sons of Camden, N. J., well known and extensive manufacturers of gas machinery. The work last referred to requires casting of the heaviest description, and a class of work made only in a very few places in the country.

EXHAUSTER AND ENGINE.

The former of these is located in a handsomely finished room 21 by 17 feet, with walls and ceiling hard finished and the floor oiled. The exhauster is intended to move the gas more rapidly from the retorts, and thus relieve them of a damaging pressure when working. It is a comparatively modern improvement and has some ingenious appendages to prevent accident by obstruction or sudden stoppage. A "by pass" is arranged to act automatically, so that if the exhauster should suddenly stop, self-acting valves are thrown open and the gas passes on without harm. It has also a "compensator" attached which is intended to supply the gas to the working side when a vacuum is threatened by the over-speed of the engine, thus preserving an equilibrium of pressure under whatever speed the engine is worked. Another ingenious appendage is the "governor," which is connected with the compensator and engine, and by which the quantity of steam and the consequent speed of the engine is made to conform to the volume of gas which the exhauster is required to pass. This machine was furnished by the Smyth & Sayre's manufacturing company, New York, and is a most creditable piece of work in all particulars. A six-horse power, horizontal, piston engine, built by Woodbury, Booth & Co., of this city, and finished in their neatest style, occupies the room adjoining the exhauster, and finished similarly. The shafting, hangers and pulleys were fitted by the Kidd foundry and steam engine company, and put up by Messrs. Lutes & Cowles, millwrights. The boiler—a ten horse power tubular—occupies another department, and was also made by Woodbury, Booth & Co. The machinery and apparatus throughout is arranged and finished with reference to the highest degree of neatness and efficiency possible to attain in a gas works. The company have abandoned their old retort and purifying buildings. The former will be reconstructed internally within two or three years, and the latter will soon be fitted up to receive a new station meter and governor, with necessary valves, etc. The cost of these improvements will be about $150,000, which amount will be increased to $200,000 by the erection of a new gas holder next season. The present capital of the company, which has recently been increased to cover these extensions, is $500,000. Thirty-five miles of main pipe have been laid (3 miles the present season), and the company supply 3,600 private consumers, and 900 public lamps.

THE COMPANY

enjoys the confidence and respect of the community, and spares no pains or expense to comply, as far as lies in its power, with the desires of a city which is only backward in the matter of gas; we refer to the nonsensical idea that anything short of lighting the public lamps from dusk till daylight will do. Of course the company is not responsible for any lack of enterprise on the yart of the city. Every attempt is made to furnish the best of gas, and large outlays have been made to secure that desirable end. Occasionally the gas is not of the most agreeable odor, a fact that is accounted for in various ways. A few weeks ago the gas stunk horribly, the smell resembling double-distilled extract carrior. This was caused by the change from the old to the new purifiers, the former being crowded beyond their capacity during their change.

THE SUPERINTENDENT,

George W. Parsons, is principally responsible for the able and efficient manner in which the business of the company has been transacted. He entered into the service of the company in February, 1849, and may be said to have attained his second majority in the business. The neatness of everything about the works (a lady with everything but a long train could go through every part of it without getting her attire spoiled), the system with which everything is conducted, and the various improvements mentioned above, are due to Mr. Parsons. The company fully appreciate the fact that his services are invaluable, one evidence of which is the long time they have retained him. The position is one of that character that not one man out of a thousand could be found posessing all the requisite qualifications, but Mr. Parsods is that man. He is ably seconded in the care of the company's interest by Major T. E. Parsons, Mr. Virhoeven, James White, and others.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—EDS.]

Experience of a Gas Engineer.

ENGLEWOOD, N. J., Jan, 26, 1870.

Messrs. Editors: I send you the following statement of my introduction to a gas house, and some of my experience up to the present time, and although it may be of little value to many who manage a gas works at this day, there may be some, particulsrly those just entering into the business, who may derive some trifling benefit from what I state.

Having a practical knowledge of gas-fitting, I commenced about twelve years ago as a stoker in a small gas house, at a salary of six dollars per week, with the benefit of what gas-fitting there was in the town. My prospects for information were not very encouraging at first, from the fact that the then superintendent would not give me the slightest insight into the process of gas making, purifying, etc. Such a course only made me the more desirous to find out the mystery, and while he was snugly in bed I was exploring around the purifiers, condensers, etc. In nine months I took charge of the works, and immediately commenced the removal of my first trouble. A bench of two retorts were then working from the same fires, but separated by a brick partition, and while one of them would show a good heat the other one would not. I was satisfied that the flue was stopped at the back, but the brick wall of the main building being only nine inches from the brick work of the bench, there was not space sufficient to work between the two, for the purpose of knocking a hole into the flue, so I thought I would try the power of steam on it. I took a gas-fitter's torch, hall filled it with water, and plugged it up tight; I then took out the sight hole box in front, which opens into the flue, put in the torch, and with a long poker pushed it to the back end of the flue, and then closed the sight hole box and took out the one over the retort. Very soon the report came, and by the whirlwind of dust that came out of the upper sight hole, I knew it had accomplished the object. Three months afterwards I knocked a hole through from the back, and when it became filled was easily remedied. My next trouble was that I could not keep a sufficiency of water in the station meter; it leaked out into the pipe leading from the centre seal and soon filled it up. I disconnected it and found that the drum had been bearing on the dry well pipe, and had worn a hole through it at the angle and below the water line; I took it out and soldered the hole up without consulting the meter maker, or any one else.

Respectfully yours.

T. T. T.

[The above letter will be interesting, doubtless, to many of our novices in gas making, if not some of the older heads.—EDS]

Information Wanted.

ENGLEWOOD, N. J., Feb. 7, 1870.

Messrs. Editors: If at any time you may have space in your Journal I should be pleased to have an answer to the following questions by some of your subscribers that have made the practical test.

I have three meters—three light, five light, and ten light, marked respectively 25 feet, 40 feet, and 80 feet per hour. Am I to understand that that is the maximum amount that can be passed through the above meters?

Take a meter whose inlet is the size of the service pipe and connections, and passes a certain amount of feet per hour; increase say one-fourth the size of the service pipe and lead connection. What is the difference?

Note—the utmost amount of gas that will pass through a three-light meter in a given time, the supply pipe being the same size as inlet of meter; take off the union from the lead connection and solder on a five-light connection, and then attach a five-light meter. What is the difference?

Tap a main for one-inch pipe, put in a nipple and then a socket 1 x 1¼ inch, and run 1¼ inch pipe, say 50 feet, and put on a meter to correspond, how much advantage over running one inch pipe all the way; or

how much loss by not running 1¼ inch pipe all the way?

While employed in the service department of a gas works last fall, I was ordered by the secretary to take out a three-light meter of a consumer and put in a five light; the rising pipe was only a quarter of an inch, and only two burners were taken off the pipe, whose whole length was not more than twenty feet. Where is the advantage of the five-light meter in this case?

If the above questions are answered it will save me a little trouble, as otherwise I shall fit up an apparatus and test the matter for myself.

Respectfully yours,
THOMAS T. TASKER.

Answer to John Keeling about Exhausters.

OREGON IRON FOUNDRY,
738 GREENWICH ST., N. Y., Feb. 9, 1870.

Messrs. Editors: Your correspondent, John Keeling, is led to say that to work an Exhauster "with one and a half inch vacuum is worse than madness; and as far as the public are concerned, direct robbery." We think the gentleman is hasty in his conclusions; we have put up in working order a great many Exhausters in this country, and if the gentleman will call on us when in this city, we can introduce him to more than one large Exhauster making under one and a half inch vacuum, without giving one third air, or anything in the least like it. Respectfully yours,

HERRING & FLOYD.

How Phosphorus is Made.

The earthy matter of bones consists of three equivalents of lime united with one equivalent of phosphoric acid. It is what chemists term "a tribasic phosphate of lime." Phosphoric acid consists of one equivalent of phosphorus united with five equivalents of oxygen. In order to obtain the phosphorus, it is only necessary to take away those five equivalents of oxygen, which we can do by mixing the compound with charcoal after some preliminary operations, and heating them together. The charcoal takes away the oxygen and forms carbonic oxide with it, while the phosphorus distils over. In this way we get phosphorus in the condition in which you are very familiar with it. It is a wax-like substance, which must be handled with care, because if you allow it to dry, the heat of the fingers would be sufficient to inflame it.

Now observe what this substance looks like. It is semi-transparent; it is soft; you can cut it like wax. It is exceedingly poisonous, and in the making of lucifer matches it is found to be a very insidious poison. Lucifer match makers are apt at first to be subject to an affection which does not draw much attention. They complain frequently of tooth ache, but know not the insidious disease which is creeping upon them. The lucifer match makers who make lucifer matches from this phosphorus, are subject to the most distressing of all diseases; the jawbone becomes destroyed, and frequently disappears or becomes useless, and some of them spend the greater part of their lives in the wards of hospitals. It therefore became an important point for science to find some way by which this phosphorus should be deprived of its poisonous properties without losing those chemical characteristics which make it so useful in making matches for instantaneous light.

Prof. Schrotter, of Astoria, met this want of science in a very skillful way, as follows: By taking common phosphorus and exposing it for some time to a temperature of 47 degrees, this yellow, waxy, transparent substance transforms into a dark, brick-like substance. It is no longer so inflamable as to ignite spontaneously. It may be packed up in boxes without danger of spontaneous combustion; but what is more important, it has lost all its poisonous properties. The phosphorus which was poisonous before, is no longer poisonous in this condition, and it is still capable of being used for making lucifer matches.

Disinfecting Fluid.—The Board of Health of the city of New York have recommended a disinfecting fluid composed of the following constituents; 1. Sesquichloride of iron. 2. Chloride of Manganese. 3. Chlorine. 4. Carbolic acid. The sesqui-chloride of iron has been found by experiment to deoderize more effectually than chloride of lime, sulphate of zinc, or other disinfectant. It is therefore recommended as an important constituent of any disinfectant. Carbolic acid has a marked effect in preventing fermentation and putrefection, and is particularly destructive to insects and lower forms of life. In consequence of improved methods of distillation of coal tar products this substance can now be obtained in large quantities and at reasonable rates. A disinfecting fluid having a proper mixture of the above constituents would be a valuable article of commerce.

MISCELLANEA.

At Harvard two new dormitories and a large chemical laboratory are projected. The library building is also to be greatly enlarged.

Steel rails are to be laid along the entire line of railway between Paris and Marseilles. It will require 137,000 tuns.

William Cornell Jewett has obtained from the King of the Netherlands a concession to land and use on Holland soil an ocean cable from New York. Mr. Jewett intends laying the subject before the President at an early day.

A Russian engineer has run a railway train successfully from Cardiff to Kutschigan, a distance of 53.6 miles, the only fuel applied being raw commercial naphtha.

Prof. Loomis, who claims to have discovered a way to transmit messages by electrical air currents without the aid of wires, wants to be appointed Consul to some European port, that he may experiment on the summit of Mount Blanc.

Petroleum.—The importers of petroleum of Bremen, Hamburg, Antwerp, and other towns, held a meeting recently at Bremen, and adopted resolves, recommending the adoption in the United States of the custom of branding casks with tare and weight, and of allowing two pounds for absorption by the cask, and that the resolutions be sent to New York, Boston and Philadelphia.

The New Chilian Line.—This land line is to start from Valparaiso, passing through the capital, Santiago, Santa Rosa, and San Felipe, crossing the Andes at the mining town of San Juan; thence to Villa Maria, where it will join the line already established from Rosario to Cordoba, passing through Mendoza San Luis, and thence to Buenos Ayres, thus connecting the Atlantic and Pacific coasts of South America via the Cordillera. The contractors have been granted a subsidy of $3,000 by the Argentine government, and it is to be completed within twenty months after the signing of the contract.

Terrific Gas Explosion in Boston.—A gas explosion near Hanover and Salem streets, Boston, occurred on the night of the 8th inst., caused by a leak in the cellar. It shattered the building, blowing out all the windows, and following the sewer the flames ignited a building a hundred yards distant. A flag stone weighing nearly three tons was lifted from its bed and tilted nearly on end.

"Melene" as a Lubricator. An —insuperable difficulty attending the use of ordinary lubricators, is their decomposition at high temperatures, leaving behind a thick viscid coating which, especially in cylinders, interferes considerably with the motion it should assist. Ericsson's hot-air engine is especially difficult to lubricate, from this cause. The use of *melene* is advised for this purpose; it being a substance obtained from the paraffines, insoluble in water, soluble in the fixed oils, volatile without decomposition, not boiling under 370°, of the consistency of wax at ordinary temperatures, and floating on the surface of cold water. It is cheap enough to be used on a large scale, and preserves from oxydation and adhesion.

Sewing by Electricity.—For many years it has been a query whether the electric current might not be brought so far under man's control as to take the place of steam as a motor for machinery, and success has at last crowned the persevering efforts of scientists. At the last exhibition of the American Institute there was seen an elliptic lock-stitch sewing machine driven by a small electric engine, which might easily be put into a common hat box. A series of eight magnets are set on the periphery of a circle and around these revolves an armature of steel, which is continuously propelled by the magnetic action, and thus operates the machinery that moves the needle. Connection with this moter is had by means of a small slide within easy reach of the operator, at whose will the current may be cut off entirely, or the speed of the needle graduated as may be desired. The use of this motor, if it becomes general, cannot fail to prove of the utmost benefit to ladies, especially to machine operators, as it does away entirely with the necessity for using the feet, as is now the case, and must be highly conducive to the health of females, who suffer from many diseases that are generated by the constant strain on the pedal and limb muscles. The inventor of the engine in question is Charles Gaume.

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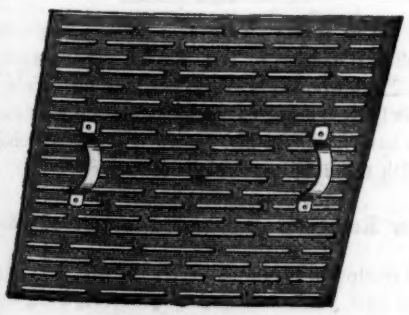

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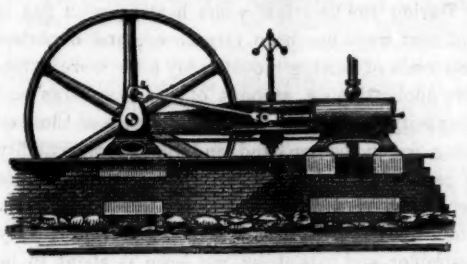

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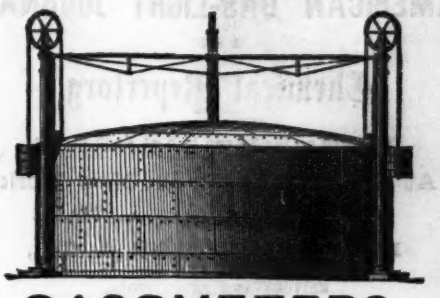

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which, with cement for laying the same, are constantly on hand in large quantities.

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will be furnished on short notice.
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For piecing Retorts end to end that are too short for their beds stopping the cracks in Fire-clay and Iron Retorts; filling up the pores and small cracks round the mouth end of Clay Retorts; for fixing the iron mouth-piece to Fire-clay Retorts; patching cracks in Cast-iron ditto; making joints of Ascension Pipes; coating new Clay Retorts, and for general repairs at all times to prevent all possible loss of gas from leakage.

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FOUR CAST IRON DRY LIME PURIFIERS 8 x 12 feet, and 2½ feet deep, inside measurement, including Wrought Iron lids. Center Valve and ten inch Connections complete. The purifiers have ledges for three layers of lime trays. Address, Cincinnati Gas Light and Coke Company, Cincinnati, Ohio.

The four Purifiers will weigh, say	24 000 lbs.
Center Valve, Tank and Pipes, say	7 000 "
Ten inch Connections, say	5,500 "
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232-tf. SAMUEL A. THOMAS, Engineer

THE

AMERICAN GAS-LIGHT JOURNAL,

AND

Chemical Repertory.

Published on the 2d and 16th of Each Month

At No. 22 Pine Street, New York.

M. L. CALLENDER & CO.,

EDITORS AND PROPRIETORS.

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Geologist and General Scientist,
PROFESSOR HENRY WURTZ.

[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

WEDNESDAY, FEBRUARY 16, 1869.

WISHING TO MAKE this Journal an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

Subscribers would confer a favor upon us by remitting *CHECKS* or *POST OFFICE MONEY ORDERS*, as we are frequent losers where money is enclosed in letters.

☞ NEWS AGENCY.—The American News Company, 119 and 121 Nassau street, New York, are agents for this Journal. Newsdealers will please send orders to them.

NOTICE.

☞ *All Collections for Advertisements, Subscriptions, etc., are made directly from this Office. We have Agents to solicit the same, but they are not authorized to Receipt for Money.*

TO OUR SUBSCRIBERS AND PATRONS.

In making remittances for subscriptions, always procure a draft on New York, or a POST OFFICE MONEY ORDER, if possible. Where neither of these can be procured, send the money, but always in a REGISTERED LETTER. The registration fee has been reduced to fifteen cents, and the registration system has been found by the postal authorities to be virtually an absolute protection against losses by mail. ALL Postmasters are obliged to register letters whenever requested to do so.

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THE USE OF GAS AS FUEL.

During the last few years heating with gas in different ways has been introduced, and doubtless this mode of heating would enjoy a far more extensive application on account of its cleanliness and simplicity were it not for the high price of illuminating gas on the one hand, and the impracticability of generating gas on the principle of Sieman's gas generator, on a small scale, on the other hand. The supply of a cheap article seems, therefore, very desirable; and this object we learn is about to be realized by the gas works now building at Fürstenwald near Berlin. The gas is to be generated from lignites at Fürstenwald, about twenty-two miles from Berlin, and carried to the latter city by means of pipes. For this purpose there will be erected at Fürstenwald twelve buildings each 105 by 62 feet, with an aggregate of seventy furnaces, each containing ten retorts. The furnaces will be provided with Sieman's regenerator. The gas after having been freed from tar, water, etc., by passing through condensers, is brought to Berlin through a series of pipes four feet in diameter, into which it is forced by four cylinder-blasts of seven feet seven and a half inches diameter and six feet stroke. The blasts are propelled by four steam engines of six feet stroke, and 360 horse power each—capable, however, of working up to 500 horse power. The pressure of the gas in the pipes is intended at sixteen feet water, equal to about seven pounds to the square inch, since this comparatively high pressure allows of a smaller diameter of the pipes, and seems to offer a lower one in many other respects. The pipes are to be made of quarter inch boiler plates, and not buried, but laid above ground, to render them at any time easily accessible, and supported in an appropriate manner by stone pillars. Under a pressure of sixteen feet water, the pipes will deliver 407 cubic feet per second.

At Berlin the gas will be stored in twelve gasometers, each 154 feet in diameter and 40 feet high, having therefore a capacity of about 750,000 cubic feet. From these gasometers the city is to be supplied. From experiments made by Dr. Zuirck of Berlin, it seems that a gas of good heating quality can be made from the Fürstenwald lignites. The components of the gas at a specific gravity of 0.5451 is said to be as follows:

Hydrogen	42.36	per cent.
Carbonic oxide	40.00	" "
Heavy carburetted hydrogen .	11.37	" "
Nitrogen	3.17	" "
Carbonic Acid	2.01	" "
Carburetted hydrogen (condensible)	1.09	" "
	100 00	

If this composition of the gas can be regularly maintained throughout, it will answer its purpose perfectly. The experiment shows that 3000 cubic feet of the gas are equal in heating power to one ton of lignite, or one third ton of hard coal. The price at Berlin is rated at twelve and a half cents gold per thousand cubic feet, and the equivalent of one ton of hard coal will cost in Berlin $1 12½ cts gold. The capacity sf the works are calculated at 9,500,000 cubic feet per annum, or about ten and two third millions per day, which is said will cover the demand of about half the city.

[We are glad that we are able to publish this article, inasmuch as it goes ao show the practicability of conducting gas considerable distances. This fact will be especially interesting in connection with a very novel, and what is sure to be a vastly profitable gas enterprise being organized here, which we shall be pleased to explain fully to our readers in a short time.—EDS.]

REPORT OF THE WATER COMMISSIONERS OF JERSEY CITY.

The twenty-second report of the Board of Water Commisioners to the Mayor and Common Council of Jersey City has been placed before us, from which we learn that the works are now in better condition, and more capable of doing the duty required of them than at any time since they have been in use. An addition has been made to the engine house, two comfortable double houses have been built for the residence of such of the fireman and other hands that were not provided for; a drilling machine of the very best make, several hydraulic jacks and other handy articles have been added to the stock of tools at the engine house.

More than usual extensions have been made to the distributing pipes, and a contract has been signed for supplying the city of Bergen with water through pipes laid by them. To pay for the extensions which have been made, seven per cent bonds have been issued to the amount of $100,000 payable in the year 1899. One pressing need now is of a reservoir at a high level, some distance north of the present Bergen reservoir, with pumping machinery for elevating a portion of the water to a sufficient height to supply the whole of Hudson City, instead of a small portion as at present.

It seems from the steady and certain increase in the consumption of water, that in the summer of 1874 the level of the water in the Bergen reservoir will be steadily going down, and the works, as they are, will not, if they do their best, and no accident happens, be able to keep up the supply.

One noticeable feature of the business of the last year is the closeness with which the receipts from measured water approximate to the rates received from houses, etc., not measured but assessed according to size. The county has laid a line of about 13,000 feet of six-inch pipe for the use of the poor house at Snake Hill which will add to some extent to the receipts from the first named source. An unusually large quantity of sewer building has been ordered and put under contract, a large part of which will not be completed until next season.

SPECIAL NOTICE.

Sabbaton's Patent Coke Screening Shovel has been in use for the last 10 years, and is now extensively adopted by many of the most important gas companies of the United States, who consider them indispensible. They are made of malleable iron, very durable and perfect in operation.

Mr. O. R. Butler, of 126 Maiden Lane, N. Y. is the sole agent, who has many testimonials from the largest Coal Gas Works, in the country.

☞ The party who sent a communication regarding the report of T. T. Tasker, Superintendent of the Englewood Gas Works, can see his article in print only by sending us his real name and residence.

We have no doubt Mr. Tasker will take a friendly tilt with the unknown knight of the pen.

New Reservoir Demanded for Brooklyn.

The receipts of the Brooklyn Water Department during the past year amounted to $582,747, being a decrease of $35,330 when compared with the year preceding. This falling off is accounted for by the fact that during 1868 the revenue was swelled by the payment of arrearages.

The report of the Board for the past year shows a deficiency of $75,000, caused by the continual extension of the Water Works. The cost of cleaning the streets was $88,000, and of repairing, about $25,000, while the repairing account shows that about $83,000

have been expended in the repaving of streets, to be paid for by local assessment.

In the report of the Engineer of the Board the question of increasing the water supply of the city is fully discussed. The Water Works were intended to supply 20,000,000 of gallons per day, but during the past summer the maximum consumption reached 19,000,000, so that the immediate increase of the city's supply is demanded. The plan recommended by the engineer is to build a reservoir near Hempstead, L. I., and store therein during the season when the ponds are overflowing, about 3000,000,000 of gallons, so that by adding the ponds now owned by the city, the maximum supply can be increased to 40,000,000 of gallons per day, which, in the opinion of the engineer, will be sufficient for fifteen years to come. The reservoir at Ridgewood will also have to be doubled in size.

Annual Report of the Northern Liberty Gas-Light Company.

Clay Retorts vs. Iron Retorts.—We subjoin the report of the Northern Liberties Gas-Light Company, Philadelphia, which will be generally interesting to gas men; but more especially that part of the report regarding their experience in the use of fire-clay retorts, and bricks, tiles, etc.

There is a great difference as to the character of clays used to manufacture these articles no doubt, and it is well known that the manufacturers have secrets in the art of their own, which they claim give a superiority, especially as to the durability of the manufactured materials. Good fire-clays are getting more and more scarce in certain localities, and this may have something to do with the poorer quality of the retorts, etc., experienced by the trustees of the Northern Liberties Gas-Light Company.

If one manufacturer does not turn out good work another will. It is not worth while to consider the feasibility of going back to iron retorts. New clay beds are being discovered, some of which we know are equal to any foreign clays, and new manufacturers are sure to supply the demands whatever they may be, if the old ones will not.

The Trustees of the Northern Liberty Gas Company herewith present a statement of the receipts and disbursements of the past year, with the previous outlay of capital:

RECEIPTS.

For sales of gas		$148,608 22
For sales of coke, tar, &c.		9,807 57
		$158,415 79

EXPENDITURES.

For works as per last report	$190,450 70	
During 1869	5,916 58	
		$196,367 28
For mains, ar per last report	$68,232 23	
During 1869	824 61	
		69,056 84
For services, as per last report	$54,768 81	
During 1869	1,838 74	
		56,607 55
For meters, as per last report.	$55,334 43	
During 1869	1,218 25	
		56,552 68
For real estate as per last report		31,206 83
For coals on hand at commencement and received during the year	$78 375 57	
For wages, taxes &c.	61,324 10	
		139,699 67

It is deemed consistent with the object of the foregoing statement to notice any feature of moment which, occurring in the past year, may have relation to the operations of the company. The supply of gas and the price of it seems to be of the first interest, and it is but to continue the unvaried assertion of all former reports of the trustees of the company to say that an ample supply of the best quality has been furnished at all times; and the price during the year has been $2 55 .100ths per thousand cubic feet to private consumers, and $1 29½ 100ths per thousand cubic feet for that consumed by the public lamps.

The works have required extensive repairs since the last annual statement—more than was then anticipated. One of the gasholders needed many sheets of iron to replace those destroyed by corrosion, and indications point to continued expenditures in this direction. The walls of the retort house had become unsightly and dangerous. Owing to the settling of their foundations, it was necessary to take down the walls and rebuild them. In doing this it was determined to render them more substantial than they were at first, so the eastern wall, which was but thirteen inches thick, was replaced by another of eighteen inches; the western wall being of eighteen inches thickness, was rebuilt of the same dimensions. These and other repairs within the year amounted to $20,126 37.

The trustees regret to notice a fact which, confined to this company, seems to be of limited import, yet it is not without a wide-spread and general concern. They refer to what they feel justified in representing as a deterioration in the manufacture of fire clay, as applied to gas making—retorts, blocks, tiles, and bricks. This company has never realized the great durability that is claimed for clay retorts. In some quarters they are represented to last one, two, and even three years, doing efficient service all the time. Their average duration in these works will not exceed eight months, and much of that time they have been clogged with carbon. When first introduced, however, and for a year or two after, they may be said to have lasted from ten to twelve months. Nor is the case much better in regard to the fire clay brick. A stack of arches for gas retorts, properly built, might reasonably be expected to stand ten years without renewal. In the spring of 1868 the company erected a stack of arches, giving especial care to its construction, and to the selection of the material, and it is now inevitable that the arches will be unsafe to use another year. Whether large profits have made the manufacturers careless, or whether they have lost the art of mixing the varieties of clay to produce a compound that will resist heat, without shrinking and without destruction, is a question which the trustees cannot attempt to solve, but while they are compelled to use the fire-clay brick they are forced to contemplate with much seriousness a return to the use of iron retorts as a matter of economy in the management of the works under their charge. As intimated in the report of January, 1869, an increase of the capital of this company in the amount of $200,000 was granted by the Legislature, and the authorized capital now is $600,000.

Respectfully presented,
Wm. P. Fodell, Secretary.

Answers to Correspondents.

C. J., of Pha. Pa.—Your hydrogen machine will deposit sulphate of iron when the solution is sufficiently saturated. Introducing small twiggs or shavings etc., will facilitate the precipitation.

T. L. B., of Ohio.—Silver is soluble in nitric acid: the two substances combine, forming the article commonly known as lunar caustic—nitrate of silver.

J. P., of Ind.—You can procure the Patent Office Reports by applying through your member of Congress.

N. O. T., of Cal.—The information you desire in regard to "flow of gas" and measurements, etc., can be had of Messrs. Harris & Brother gratuitously, by sending for the "Gas Engineer's Pocket Companion."

Salem?—We have received a remittance from Salem, but the letter has not the name of the State. What State is it?

Correction.

In the correspondence of T. T. Tasker, descriptive of Englewood Gas Works, in the last issue, the following errors occurred: In speaking of the sizes of gas mains the word *pulleys* was printed twice, when the word mains should have been used. The sentence commencing: The works are six inches, should read: The connections of the works are six inches, etc.

PROFESSOR HENRY WURTZ

HAS EFFECTED ARRANGEMENTS WHICH give him especial advantages in Analyses of Gas and Gas Coals, and in the practical determination of the value of Coal for Gas-Making purposes Analyses of Ores, Minerals, Mineral Waters, etc. No. 26 Pine street, N. Y.; or this office

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Patent Gas Works,

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OIL AND ROSIN GAS WORKS (all sizes) for Towns, Factories, Plantations, Churches, and Private Dwellings. These Works are warranted to make cheaper gas than any small Works known, and are very simple to manage. Refer to *over three hundred now in use from one to thirteen years.*

Estimates furnished for cost of Works, and the cost of manufacturing Gas in various localities.

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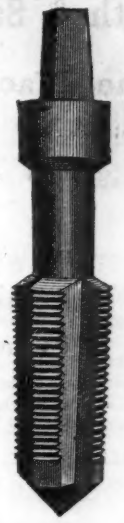

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CONDENSED DRILL, REAMER AND TAP.

The best tool for Tapping Gas and Water. Address,

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244–6m

FOR SALE.—THE FOLLOWING SECOND Hand Gas Apparatus: One Meter, six-inch connections; Castings for seven Benches, Mouth-pieces, Lids, Stand Pipes, Bridge and Dip-pipes, Hydraulic Main, Center Seal, Condensers, Purifying Boxes, and Connecting Pipes, all in good condition. Will sell all or any portion of the same. Address,

GEORGE K. REED,
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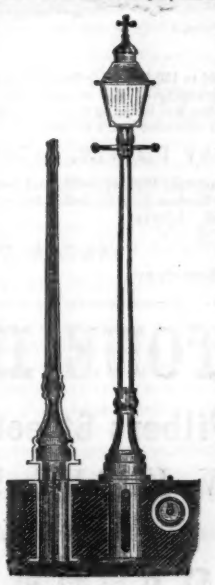
244-3t

BRANSON'S PATENT LAMP POST.

THE ADVANTAGES OF THIS PATENT POST over the old style, are as follows:



1st. The saving of the base or bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather: all this is obviated in this Post, as no digging is required. This style of Pos is especially desirable when flag stone sidewalks are used.

3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one third of the original cost is saved by the base being secured and perfect.

Rights for States, or the United States, on reasonable terms Address, Editors Gas-Light Journal, 22 Pine street, N. Y.

Certificate.

St. Louis, September 1, 1869.

I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted, as I believe it possesses all the advantages claimed for it.

The St. Louis Gas-Light Company have adapted this Post and ordered a large quantity for immediate use.

THOMAS PRATT,
Sup. St. Louis Gas Works.

537-6m

S. FULTON & CO.,

PLYMOUTH IRON WORKS,

Conshohocken, Pa.

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PIG IRON & CAST IRON GAS & WATER PIPES.

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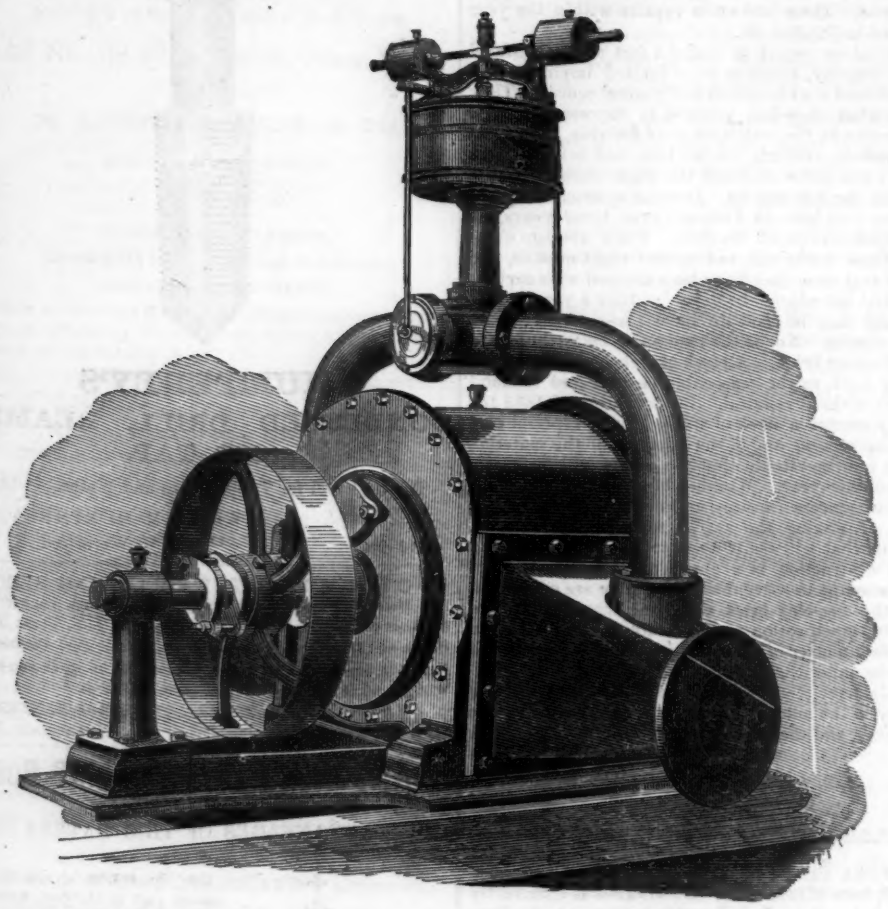

They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, either clay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

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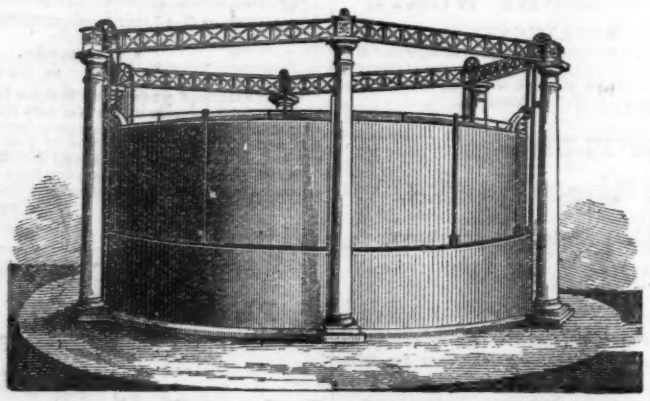

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FIG. 1.

Fig. 1 shows a single gate valve.

Fig. 2 represents wedge and one-half of gate of double valve, intended for larger sizes, when required to bear heavy pressure either side.

Fig. 3, represents a section through body, gate and wedge.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

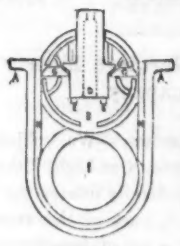

FIG. 3. FIG. 2.

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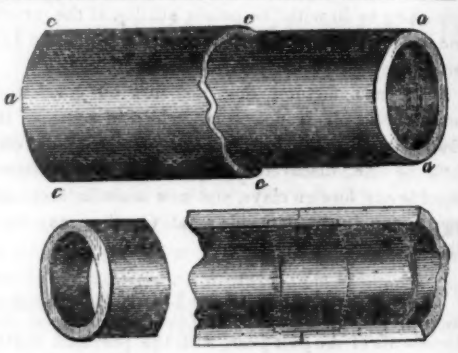

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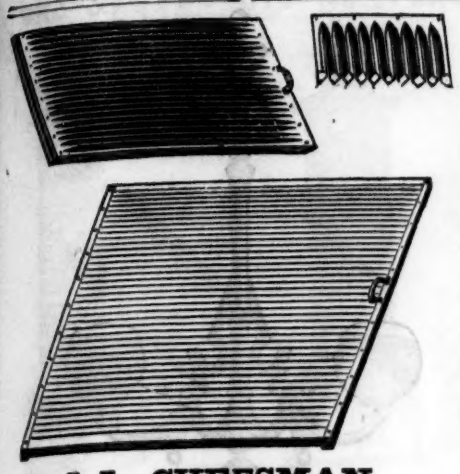

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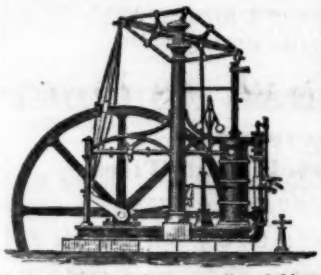

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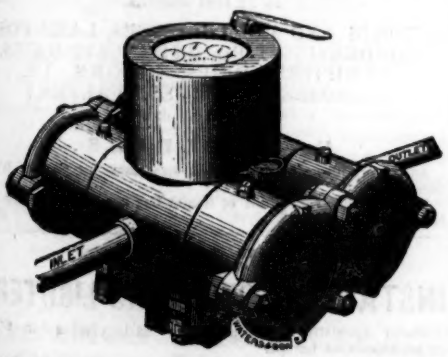

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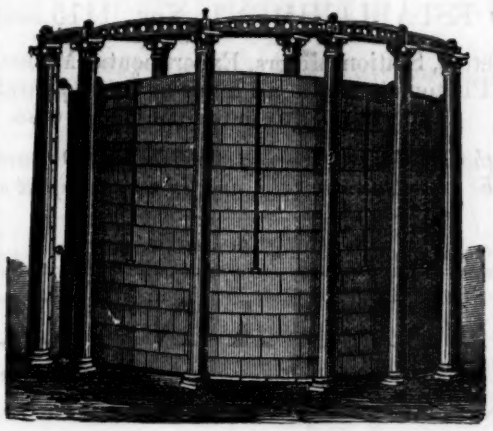

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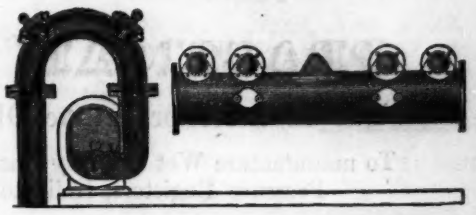

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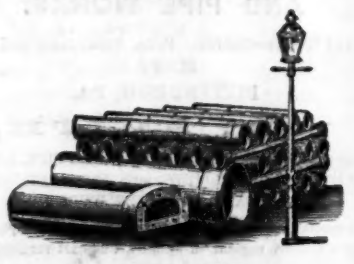

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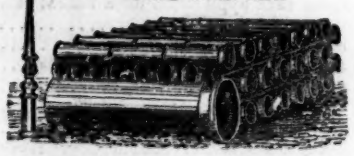

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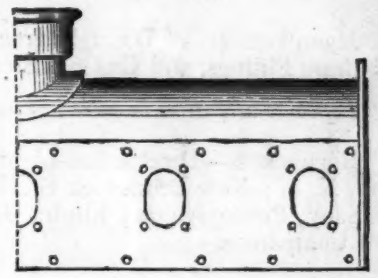

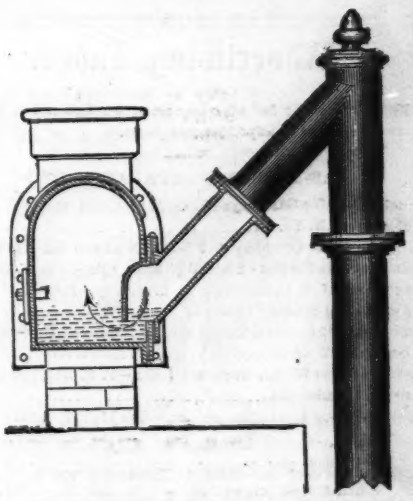

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